UNITED STATES

NUCLEAR REGULATORY COMMISSION

REGION IV

URANIUM RECOVERY FIELD OFFICE
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JAN 21 1994

Docket No. 40-8943
SUA-1534, Amendment No. 22
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X61199

MEMORANDUM FOR: Docket File 40-8943

FROM: Joel P. Grimm, Project Manager

SUBJECT: MINE UNIT NO. 1 RESTORATION PLAN - FERRET'S CROW BUTTE ISL FACILITY

INTRODUCTION

On November 1, 1993, Ferret Exploration Company of Nebraska, Inc. (Ferret), submitted a license amendment request to the NRC addressing a requirement to submit plans for each solution mining unit prior to beginning ground-water restoration. The request was made in accordance with License Condition No. 51 in light of the licensee's preparations to restore Mine Unit No. 1 at Crow Butte. The plan included some minor variations from the generic description of ground-water restoration provided in the licensee's original application. Therefore, the changes also require review and approval.

NRC will take an opportunity with this request to review the basis of this license requirement. While aquifer restoration is an integral part of protecting public health and the environment at solution mines, reviewing and approving restoration plans for each mine unit is redundant and inefficient. It is likely that consistent aquifer restoration procedures will be conducted throughout the course of the Crow Butte project. Therefore, NRC will alter License Condition No. 51 requiring that all mine units be restored in compliance with preestablished restoration criteria. Future reviews of and changes to the basic restoration program will be made only upon request and justification by the licensee, or if the approved plan is found to be deficient.

BACKGROUND

Ferret initiated uranium solution mining from mine unit No. 1 during April 1991. Uranium head grades in the lixiviant were approximately 100 milligrams per liter (mg/l) during the mining process, and decreased as the uranium ore became depleted. No longer economically productive, the mining process will be terminated, and the aquifer restoration process begun.

Ferret proposes to conduct and demonstrate aquifer restoration in four major phases: (1) ground-water transfer, (2) ground-water sweep, (3) ground-water treatment, and (4) well-field recirculation. The first phase is newly proposed by Ferret, and involves exchanging baseline-quality ground water from a newly drilled mine unit with degraded water in the depleted mine unit. Ground-water sweep involves producing degraded water from the mine unit, while eliminating all injection. This step produces the most degraded ground water, and delivers it to evaporation ponds. Additionally, this step flushes the affected mine unit with clean ground water from the surrounding aquifer.

Treatment follows ground-water sweep, and conducts waste water through reverse osmosis equipment. Here, dissolved solids in the water become concentrated in 25 to 40 percent of the waste stream, while the remaining water becomes purified. Depending upon the efficiency of the equipment and procedures used, reverse osmosis treatment is capable of producing essentially pure water. The purified water, known as permeate, can be reinjected into the aquifer to promote additional aquifer restoration, used as a processing water supply, or disposed of as authorized. The concentrated brine is retained for evaporation.

Finally, aquifer recirculation is performed to homogenize ground-water quality throughout the mine unit, providing more accurate mine-unit average water quality data for the purpose of demonstrating the aquifer is restored.

DISCUSSION

Ground-Water Transfer

Ferret's proposal to conduct ground-water transfer involves exchanging degraded ground water in an unrestored mine unit with clean ground water in a newly drilled mine unit. The exchange chemically alters the degraded mine unit with naturally occurring ground water, promoting the restoration process. This step provides the additional benefit of reducing the total volume of restoration waste water requiring disposal.

Water transfer will promote aquifer restoration in two ways. First, it will physically remove degraded water from the older mine unit and place it in a mine unit which will eventually become degraded by mining. Therefore, the total dissolved solids (TDS) will be lowered in the mined aquifer. Secondly, chemical conditions of the natural ground water will promote stripping cations which became attached to clays during the mining process.

Ground-Water Sweep

Ground-water sweep involves producing degraded water from the mine unit while discontinuing well-field injection. The procedure draws degraded mine unit water as well as natural ground water toward the center of the mine unit. Thus, a cone of depression is established causing water to flow into the mining unit. Waste water resulting from this process is retained in

Thus, a cone of depression is established causing water to flow into the mining unit. Waste water resulting from this process is retained in evaporation ponds. During Ferret's research and development (R&D) operation, this stage was continued until the majority of the injected solution was recovered from the area surrounding the well field. Samples from the injection wells and comparative volume calculations are utilized to determine when this phase is complete.

Ground-Water Treatment

After ground-water sweep is completed, the permeate injection/reductant stage will be initiated. In this stage, the water recovered from the well field is treated and recirculated into the aquifer. The water will first be processed by ion exchange to remove remnant amounts of uranium, and then by reverse osmosis to remove other dissolved solids. The resulting permeate can be injected into the mine unit to promote further restoration. Brine solution from treatment will be retained in an evaporation pond. The beneficial results of reverse osmosis treatment include (1) reducing TDS levels in the contaminated ground water, (2) reducing the net volume of water resources requiring removal from the aquifer and disposal, (3) concentrating dissolved chemical constituents in a smaller volume of waste water, and (4) enhancing exchange of ions from the mine-unit sandstone and clays to the water due to ion concentration differential.

If required, this flushing process will be accompanied by reductant injection. Its purpose is to reestablish reducing conditions in the aquifer; immobilizing various trace metals found in the degraded ground water. Ferret proposes to employ either aqueous H_2S or Na_2S as the reducing species, and commits to providing a comprehensive safety plan for using these chemicals.

Aquifer Recirculation

Recirculation, while not addressed in the licensee's original application, will provide a period of time during which ground-water quality will become homogenized, and will equilibrate with natural aquifer chemistry. Assuming that restoration procedures have progressed adequately, this process will provide more uniform chemical conditions in the aquifer and more reliable compliance monitoring data.

Operations

Ferret's restoration program is slated to use equipment found in the company's former pilot processing plant. The restoration stream will first be processed through small ion exchange columns to remove uranium if its concentration is elevated. Reverse osmosis equipment was used by Ferret to treat water during the pilot project at this site. The process has been reviewed and approved by earlier licensing actions, and requires no further consideration at this time.

Monitoring

Ferret has already established ground-water restoration goals by providing baseline water quality data from mine unit No. 1. Restoration goals are cited in License Condition No. 44. Ferret's monitoring plan includes a 6-month demonstration period following restoration. Ground-water samples will be collected and analyzed monthly for all restoration parameters. Each sampling series must demonstrate that chemical constituents have been restored on a mine-unit average basis before a finding will be made that restoration was successful.

NRC's review indicates that Ferret proposes to shorten its list of restoration parameters by a few constituents. The licensee responded during telephone conversations that the list of parameters was prepared to comply with State of Nebraska permit requirements. Of the parameters removed from the proposed list, nitrite is unlikely to be found in the ground water resulting from this mining project. Additionally, sampling for bicarbonate, alkalinity, and electrical conductance would likely produce redundant data with required monitoring for total carbonate and TDS. Finally, Ferret's pilot project restoration data indicate that baseline concentrations of chromium in ground water typically are below detection limits, and do not become elevated by the mining process at this site. Therefore, deleting these constituents from the monitoring program is acceptable.

Conversely, sodium is a chemical constituent which is added to the mining solutions. It remains considerably elevated during the mining process. Correspondence with the licensee indicated that sodium apparently was omitted from the revised list of restoration parameters in error. Therefore, in light of the above discussion, the proposed restoration parameters should be approved, specifying the addition of sodium to the list.

Reporting

Ferret proposes to provide restoration updates in its semiannual monitoring reports submitted to comply with 10 CFR Part 40.65. This reporting procedure is adequate and acceptable. The licensee also commits to providing independent reports for each mine unit, providing final and demonstrative restoration results for NRC review and approval.

CONCLUSION

Ferret's proposed mine unit No. 1 restoration program provides procedures equivalent or superior to the previously approved general plan. In accordance with the categorical exclusion contained in paragraph (c)(11) of 10 CFR 51.22, an environmental assessment is not required for the licensing action approving the change. That paragraph states that the categorical exclusion applies to the issuance of amendments to licenses for uranium recovery provided that (1) there is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite, (2) there is no

significant increase in individual or cumulative occupational radiation exposure, (3) there is no significant construction impact, and (4) there is no significant increase in the potential for or consequences from radiological accidents.

The licensing action discussed in this memorandum meets these criteria because it provides minor changes to an approved program. The expected nominal water quality of effluents will not change, and the expected volume of effluents will likely decrease with the proposed changes. An environmental report is not required from the licensee since the amendment does not meet the criteria of 10 CFR 51.60 (b)(2).

Therefore, pursuant to 10 CFR Part 40, License Condition No. 51 of Source Material License SUA-1534 should be amended to read as follows:

51. Ground-water restoration and post-restoration monitoring shall be conducted in each mine unit consistent with the provisions in the licensee's application and Environmental Report dated October 7, 1987, as amended by its submittal dated November 1, 1993. Notwithstanding the above references, the licensee shall include sodium in its restoration monitoring and demonstration program. The goal of restoration shall be returning ground-water quality, on a mine unit average, to baseline conditions. [Applicable Amendments: 22]

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